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ABSTRACT

As the Web becomes more popular, the interest in effective navigation is increasing. Menu design is becoming a critical issue of human computer interface design as the focus of computer applications moves from the computer as a machine to the human as a user. The purpose of this study was to investigate the effect of three different Web menu designs-simple selection menu, global and local navigation aid menu, and pull-down menu-on the users' perception and information seeking performance. Three Cyber-Shopping Mall Web sites were developed for the experiment. These Web sites had the exact same content but each had a different menu design with a constant information structure. The result showed that overall information seeking performance was best in the pull-down menu. Participants performed better in searching with the pull-down menu but were faster in browsing with the global and local navigation aid menu. However, there was no significant difference between users' perception and the three menu designs. (Contains 31 references.) (Author/AEF)

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The Effect of Different Menu Styles on The User's Perception and Performance on the WWW

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Abstract

As the Web becomes more popular, the interest in effective navigation is increasing. Menu design is becoming a central issue of human computer interface design as the focus of computer applications moves from the computer as a machine to the human as a user. The purpose of this study was to investigate the effect of three different Web menu designs: simple selection menu, global and local navigation aid menu, and pull-down menu, on the users' perception and information seeking performance. Three Cyber-Shopping mall Web sites were developed for the experiment. These Web sites had the exact same content but each had a different menu design with a constant information structure. The result showed that overall information seeking performance was best in the pull-down menu. Participants performed better in searching with the pull-down menu but were faster in browsing with the global and local navigation aid menu. However, there was no significant difference between users' perception and three menu designs.

Introduction

The popularity and accessibility of the Web has been increasing dramatically due to the explosion of activity occurring on the Internet. The Web changes the fundamental way to receive and transmit information (Wood, Brodlie, & Wright, 1996). However, navigating in the Web is often not an easy task, especially for novices (Berg, 1997; Collis, 1991; Conklin, 1987; Dieberger, 1997; Elm & Woods, 1985; Fiderio, 1988; Gray, 1993; Hammond, 1989; Jonassen & Grabinger, 1990; King, 1996; Marchionini, 1987; Sand, 1996). The potentially complex linking system and information structure awaiting Web users can cause disorientation (Conklin, 1987), increase cognitive load (Collis, 1991; Conklin, 1987) and finally lead to users getting lost in hyperspace (Hammond & Allinson, 1989; Neilsen, 1990).

Such problems have prompted research on the manner in which users interact with hypertext systems including the Web. Researchers have studied a variety of aspects of user interface for effective navigation and information seeking. Since the main purpose of a Web site is to access information and knowledge effectively, how the information is structured on the Web site and how the link mechanism is designed and presented on the menu of the Web site determines the success of the navigation effects (Berg, 1997; Halasz, 1988; Hardman, Bulterman, & Rossum, 1994; Shneiderman, 1998; Shneiderman & Kearsley, 1989).

Menu design provides a contextual or structural model for the logical and functional organization of the user interface component, as well as a means of communication between the users and the system (Lai & Waugh, 1994; Laverson, Norman, & Shneiderman, 1987; Norman & Chin, 1988; Oliveira, Goncalves, & Medeiros, 1999). Many researchers argue that menu systems should be designed to provide users with an efficient and effective organizational model for navigation (Dieberger, 1997; Jonassen, 1986; 1988; Jonassen, 1989; Marchionini, 1995; Schenkman & Jonsson, 2000; Shneiderman, Byrd, & Croft, 1997).

Although research in the field of menu design has been conducted to continuously improve navigation, it remains difficult to develop hypertext systems that can help users navigate without experiencing disorientation problems and cognitive overload, while also being able to find information effectively. Usable design guidelines and principles for the Web will maximize Web site coherence and will minimize users' cognitive overload, thereby allowing users to create an accurate mental model of the Web structure.

The main objective of this research was to investigate the effects of three popular menu designs models on the Web. The specific research interests were related to the speed of information seeking, participants' degree of disorientation, and the degree of perceived appeal of three different menu design models by participants.

Method

Three Cyber-shopping mall Web sites were developed with three different menu designs and constant information structure ($4 \times 4 \times 4 \times 4$) for this experiment. The navigation effect was measured by three factors: appeal, disorientation, and searching performance time for 15 searching tasks. The searching tasks involved two information seeking behaviors, 10 information searching tasks and 5 browsing tasks. The information searching behavior required that users find the information with more specific and analytic plan. The information browsing asked that users navigate the Web site with less specific information seeking object. 17 undergraduate and graduate students of a mid-western research oriented University participated in this study.

Research Design

The methodology used in this study was a one-way ANOVA with repeated measure experimental design. The experiment consisted of three sessions. In each session, the subject

was randomly assigned to one of three menu designs. These three treatments were three Web sites that had same information but different navigation menu designs.

- Menu Design A: simple selection menu design
- Menu Design B: global and local navigation aid menu design
- Menu Design C: pull-down menu design

The dependent variables in this study were the speed of information seeking and attitude toward each menu design. Attitude variables were constructed to investigate participants' perception on the appeal of the different menu designs and the degree of the perceived of disorientation.

Materials

Three Web sites were developed for this study. Each Web site had the same contents but three different menu designs: simple selection menu, global and local navigation aid menu, and pull-down menu.

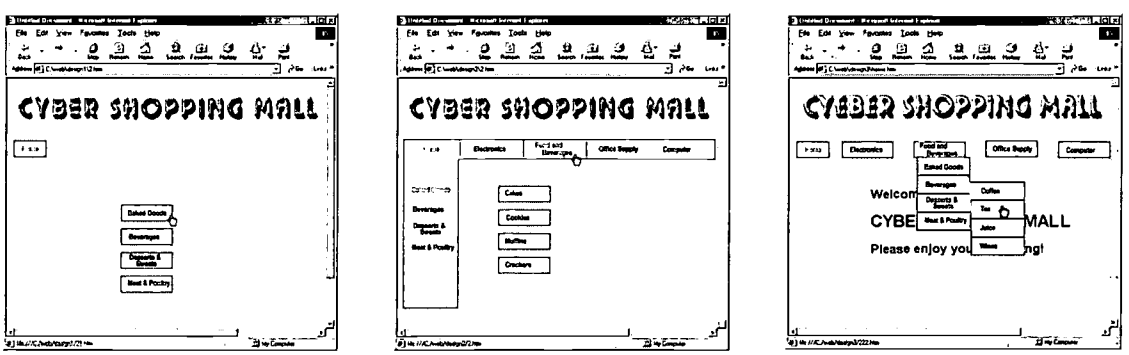

Figure 1. Three different menu designs, simple selection menu (left), global and local navigation aid menu (middle), and pop-up menu (right).

The title of three Web sites was Cyber shopping mall and the information that they contained was shopping items and the prices of those items.

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Selection of Searching Task

In order to measure the influence of different menu designs on the Web site, this study included two types of tasks: searching and browsing (Canter, Rvers, & Storrs, 1985). The merchandise items that are familiar to users were selected as the task domain. The first reason for selecting merchandise items is that the task domain should be easy enough to perform searching task without requiring any specific knowledge or skills, in order to control this variable from other factors because the user's prior knowledge of task domain can affect on the searching performance (Marchionini, 1995). Second, the shopping items can be effectively presented in the form of hypertext because they have a relatively clear relationship for categorization and can be easily structured in hierarchy. Third, shopping items have been used to examine the menu design and information structure because shopping is a common interest of people (Norman & Chin, 1988; Park & Kim, 2000).

Ten searching tasks and five browsing tasks were included in this study. The examples of each task were as follows:

- Searching task: You want to buy Epson Color 200 printer in this Web shopping mall. Please find the price of this printer in this site.
- Browsing task: Your father likes music very much and you want to buy a birthday gift for your father. Please select the music item that will make your father happy.

Participants

Total 21 undergraduate and graduate students participated at mid-western university in this study voluntarily. We excluded four subjects from final analysis because they missed at least one test session. Therefore, the actual number of subjects for the final analysis was 17. Subjects ranged in age from 24 to 36 years. They were diverse in terms of their computer and Internet related abilities.

Procedures

This experiment consisted of three sessions. During the first session, a participant was asked to fill out the background information form. It took approximately five minutes to fill out this form. After completing the questionnaire, a participant was randomly assigned to one of three treatments and was asked to find the answers of 15 tasks. The tasks were shuffled beforehand to ensure that the sequence of the tasks was random. Each task was given to the subject one at a time.

The subject was told to tell the researcher "start" before he/she started each searching task and to tell the researcher "the price of the item" after he/she found the answer. During information seeking tasks, the researcher measured the time for each task. This procedure continued until the subject finished all 15 tasks. It took approximately 20 to 25 minutes for a subject to finish all tasks. After completing the test session, the participant was asked to complete an attitude questionnaire. This took about 5 minutes.

One week was allowed to lapse between the first and second session to remove memory effect. On the second session, the subject was randomly assigned to one of the remaining two treatments. The procedure was the same.

Another week was allowed to lapse before the third session. On the third session, the subject was assigned to the last treatment. The procedure was the same.

Results

As shown in Table 1 and Table 2, there was significant difference in the total amount of time to complete information seeking performance among the three menu designs, $F(2, 50) = 7.09$, $p < .01$.

Table 1

Mean and Standard Deviation for Searching Performance Time by Menu Design

Design	N	M	SD
A	17	212.36	87.03
B	17	170.64	44.95
C	17	143.42	36.52

Table 2

Repeated Measures Analysis of Variance for Searching Performance Time

Source	df	SS	MS	F
Design	2	40991.55	20495.77	7.09**
Blocks (Subjects)	16	82376.34	5148.52	1.78
Residual	32	92509.54	2890.92	
Total	50	215877.43		

**$p < .01$.

As post-hoc contrast analysis results were showed in Table 3, there were significant differences between menu design A and B, $F(1, 50) = 5.12$, $p < .01$, and menu design A and C, $F(1, 50) = 13.97$, $p < .001$. However, there was no significant difference between menu design B and C, $F(1, 50) = 2.18$.

Table 3

Contrast Results for Searching Performance Time by Menu Design

Contrast	df	SS	MS	F
Menu Design A vs. Menu Design B	1	14793.08	14793.08	5.12**
Menu Design A vs. Menu Design C	1	40396.08	40396.08	13.97***
Menu Design B vs. Menu Design C	1	6298.16	6298.16	2.18

**p < .01. ***p < .001.

As mentioned above, information seeking performance was divided into two task types: searching task and browsing. Repeated measure ANOVA results showed that the result of effect of searching task on time to spend finding answers among three menu designs (See Tables 4-5). There was significant difference among the menu designs.

Table 4

Mean and Standard Deviation for Searching Task by Menu Design

Design	N	M	SD
A	17	137.46	68.85
B	17	116.70	37.15
C	17	86.33	23.54

Table 5

Repeated Measures Analysis of Variance for Searching Task

Source	df	SS	MS	F
Design	2	22483.02	11241.51	6.14**
Blocks (Subjects)	16	48224.07	3014.00	1.65
Residual	32	58571.54	1830.36	
Total	50	129278.63		

**p < .01.

Post-hoc contrast analysis results showed that there were significant differences between menu design A and C, $F(1, 50) = 12.14$, $p < .001$, and menu design B and C, $F(1, 50) = 4.28$, $p < .05$. However, there was no significant difference between menu design A and B, $F(1, 50) = 2.00$. In other words, based on Table 4 and 6, even though there was no statistically significant difference between Design A and B, the amount of the time of Design C ($M = 86.33$, $SD = 23.54$) is shorter than that of Design B ($M = 116.70$, $SD = 37.15$), that of Design B is shorter than that of Design A ($M = 137.46$, $SD = 68.85$).

Table 6

Contrast Results for Searching Task by Menu Design

Contrast	df	SS	MS	F
Menu Design A vs. Menu Design B	1	3663.31	3663.31	2.00
Menu Design A vs. Menu Design C	1	22221.35	22221.35	12.14**
Menu Design B vs. Menu Design C	1	7839.86	7839.86	4.28*

*p < .05. ***p < .001.

Table 7 and 8 showed that the result of effect of browsing task on time to spend finding answers among three menu designs. There was also significant difference among the menu designs.

Table 7

Mean and Standard Deviation for Browsing Task by Menu Design

Design	N	M	SD
A	17	74.90	27.87
B	17	53.94	16.12
C	17	57.09	16.30

Table 8

Repeated Measures Analysis of Variance for Browsing Task

Source	df	SS	MS	F
Design	2	4342.23	2171.11	6.71**
Blocks (Subjects)	16	10480.37	655.02	2.02*
Residual	32	10358.23	323.69	
Total	50	25180.82		

*p < .05. **p < .01.

Post-hoc contrast analysis results showed that there were significant differences between menu design A and B, $F(1, 50) = 11.53$, $p < .01$, and menu design A and C, $F(1, 50) = 8.33$, $p < .01$. However, there was no significant difference between menu design B and C, $F(1, 50) = .26$. Although there was no statistically significant difference between Design B and C, the amount of the time of Design B ($M = 53.94$, $SD = 16.12$) was shorter than that of Design C ($M = 57.09$, $SD = 16.30$), that of Design C was shorter than that of Design A ($M = 74.90$, $SD = 27.87$).

Table 9

Contrast Results for Browsing Task Menu Design

Contrast	df	SS	MS	F
Menu Design A vs. Menu Design B	1	3733.40	3733.40	11.53**
Menu Design A vs. Menu Design C	1	2695.63	2695.63	8.33**
Menu Design B vs. Menu Design C	1	84.31	84.31	0.26

**p < .01.

Results using repeated measure ANOVA showed that there was no significant difference among the menu designs with respect to two participants' perceptions: the degree of perceived appeal and disorientation of the menu design.

Discussion/Conclusion

The experiment of three different menu designs was conducted to investigate their effects on information seeking performance, the perceived appeal of each menu design, and the participants' disorientation during information seeking. Three menu designs were compared: a simple selection menu design, global and local navigation menu design, and pull-down menu design.

The results showed that participants performed the fastest information seeking in the pull-down menu design. Pull-down menu design can reduce the number of user actions and the loading time of Web pages that are not necessary to get the destination. Pull-down menus provide jump access to lower levels of the Web site. In other words, users can pass unnecessary pages in order to find information more efficiently in a pull-down menu design than in the two other menu designs.

The findings of this study also showed the significant main effect between two different information seeking strategies: searching and browsing over three menu designs.

Participants performed faster searching tasks in pull-down menu design than in others while they performed faster browsing tasks in the global and local navigation aid menu design. This study supports that the navigation mechanism influences information seeking strategy. Searching strategy is systematic, focused, and directed. People usually use a searching strategy when they have specific target or goal (Marchionini, 1995). When participants search specific information on the Web site, navigation mechanism that reduces additional user's actions to navigate in the system, e.g., mouse-clicking to pass the Web pages between start-point and final page, Web page loading to pass the further level of Web site was effective. However, when participants used browsing strategy to find their target, global and local navigation menu design was effective. This menu design provides not only

structural cues of global and local level but also flexible navigation mechanisms. Moreover, global and local navigation aid provides more information on the content of the Web site. Users who employ browsing strategies to find their target or goal need more information to access in narrowing their target as well as for navigation (Marchionini, 1995). The results of this study support the theoretical assumption that a menu design which provides more structural cues and information, along with flexible navigation mechanisms most effectively helps users perform browsing for information.

This study failed to show significant difference between either the perceived appeal of menu design or participants' disorientation and three menu designs. One explanation for no difference between menu design and the perceived appeal and disorientation by participants is that the entire information structure of the experimental Web site was simple. The information structure used in this study had four selections at each level with total 256 selections. As a result, all participants found the answers of test in each menu designs. The disorientation phenomenon usually occurs when users are unable to fulfill their task goals in the Web site by failing communicating with and manipulating to the system (Hammond, 1992).

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